APPLICATION OF JADE V&V CAPABILITIES TO THE NEW FENDL V3.2 BETA RELEASE

ID: TH/P7-32

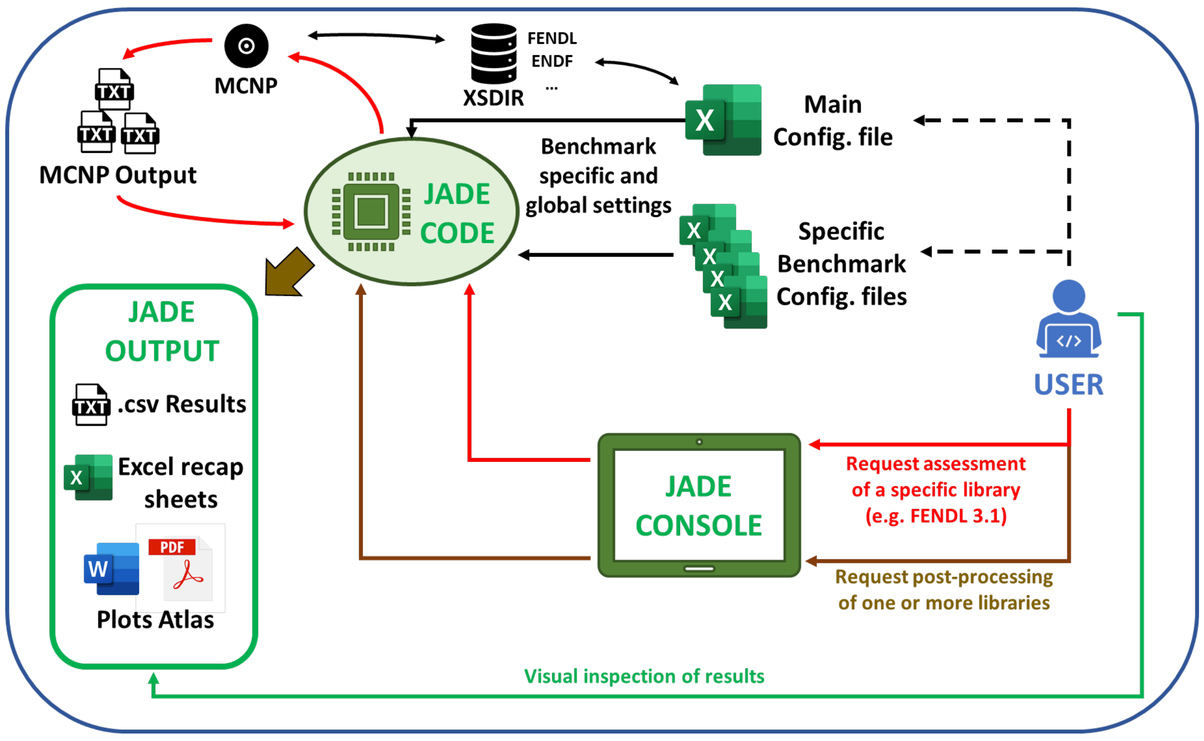
D. Laghi, NIER Engineering
M. Fabbri, Fusion for Energy
L. Isolan, University of Bologna
M. Sumini, University of Bologna
G. Shnabel, IAEA
A. Trkov, Jožef Stefan Institute

marco.fabbri@f4e.Europa.eu

ABSTRACT

- A new official release (v3.2). FENDL nuclear data libraries is expected soon.
- A Beta version have been tested on different computational experiment using JADE and compart to different version of FENDL and to ENDF-VIII.0
- JADE did not spot any formal inconsistency and the new FENDLv3.2 Beta behaviour is quite similar to the FENDL v3.1d one.
- Nevertheless, a few significant differences with respect to the previous FENDL version and to the ENDF/B-VIII.0 results have been highlighted.
- JADE has the potential to become an important player in the V&V procedures of nuclear data libraries, https://doi.org/10.1016/j.fusengdes.2020.112075 .

JADE GENERAL FUNCTIONING SCHEME



COMPUTATIONAL EXPERIMENTS

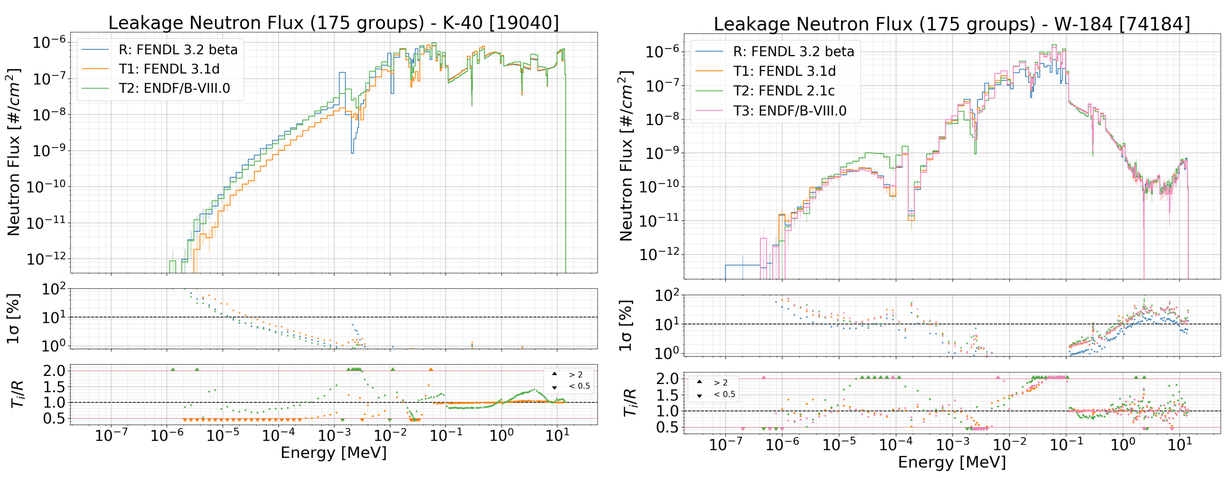
SPHERE LEAKAGE TEST

1 m diameter sphere hosting a central neutron point source equally distributed in energy from 0 to 14 MeV. All single isotopes and typical ITER material tested. Gamma and neutron fluxes, He PPM, DPA, T and heating checked.

ITER 1D benchmark

Developed by Sawan M., which is the reference 1-Dimensional neutronic model for the ITER project. This consists of a simple but realistic model of the ITER TOKAMAK where the inboard and outboard portion of the machine and the plasma region are modelled by means of concentric cylindrical surfaces. Gamma and neutron fluxes, He PPM, DPA, T and heating evaluated.

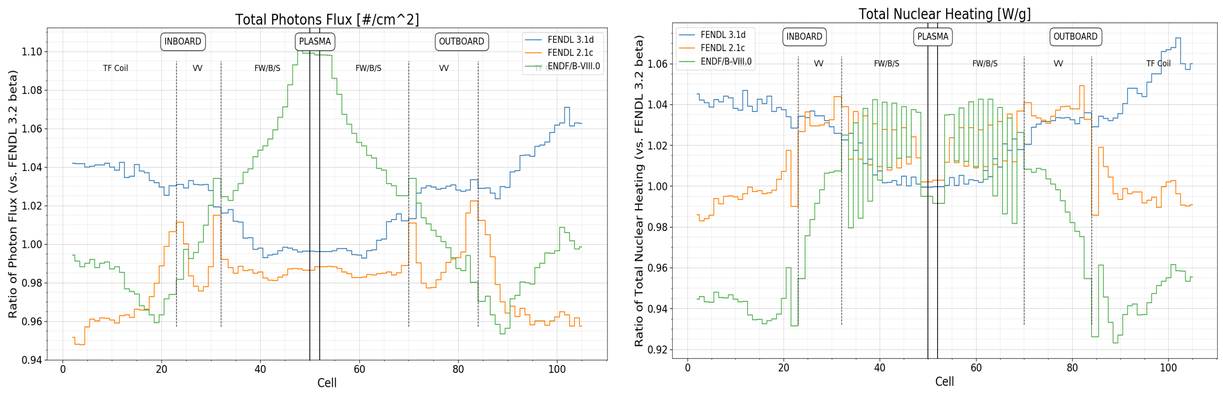
OUTCOME



Sphere Leakage benchmark spectra comparison

ZA Notation	Formula	T production	He production	DPA production	Neutron heating F6	Gamma heating F6
5010	B-10	5.17%	0.49%	100.00%	100.00%	-0.50%
5011	B-11	39.56%	16.59%	0.21%	0.59%	3.73%
8016	O-16		17.63%	-3.09%	32.79%	-20.26%
8018	O-18		-91.74%	-35.81%	-12.19%	-47.54%
19040	K-40	14.38%	20.19%	-12.74%	2.71%	-43.23%
19041	K-41	31.85%	2.68%	-9.84%	-21.56%	-33.71%
22046	Ti-46	6553500.00%	0.00%	0.00%	Identical	0.00%
24050	Cr-50	89.61%	46.91%	4.19%	13.07%	7.22%
24052	Cr-52	62.82%	33.92%	14.74%	24.65%	20.19%
24053	Cr-53	-26.45%	-100.76%	0.51%	-6.21%	12.33%
24054	Cr-54	88.15%	13.32%	11.26%	12.60%	12.77%
25055	Mn-55	-0.01%	-28.15%	0.02%	0.43%	-0.10%
26054	Fe-54	100.00%	-8.83%	7.18%	-0.70%	2.34%
26056	Fe-56	-19581.64%	0.35%	1.32%	-0.61%	2.65%
26057	Fe-57	100.00%	7.65%	-3.49%	-1.82%	-1.99%
26058	Fe-58	0.00%	0.01%	5.48%	23.11%	0.72%
28062	Ni-62		-0.01%	6.22%	11.52%	1.61%
30070	Zn-70	-0.02%	0.00%	9.65%	14.95%	1.12%
48110	Cd-110	0.01%	-0.02%	-2.49%	-242.21%	100.00%
48112	Cd-112	0.03%	-0.01%	-3.43%	-169.67%	100.00%
48114	Cd-114	0.00%	0.00%	-2.95%	-142.71%	100.00%
48116	Cd-116	-0.02%	-0.02%	-3.52%	-160.08%	100.00%
74180	W-180		-91.18%	0.00%	0.00%	0.00%
74182	W-182		-98.61%	0.74%	1.80%	5.58%
74183	W-183		-96.15%	0.00%	0.02%	0.08%
74184	W-184		-98.15%	2.29%	3.96%	11.00%
74186	W-186		-97.22%	2.68%	4.25%	12.75%
90232	Th-232		-98.43%	0.01%	-4.00%	-0.01%

Extract from the Sphere Leakage benchmark excel comparison of FENDL v3.2 VS FENDL v3.1d



ITER 1D benchmark results

CONCLUSION

- No anomalies spotted in FENDL v.3.2 beta having a clearing improvement from FEND3.1d.
- Several negative heating p-table found in the ENDF-VIII.0: whereas the Ytterbium problem was known this was not the case of Hafnium-181 and Hafnium-182.
- FENDL3.2 beta release largely aligned with FENDL3.1 but some significant variation observed in:
  - B10 dpa and heating (order of magnitudes)
  - Photon and neutron heating in Cadmium isotopes
  - T production in Fe-54-56-57 (values now corrected)
  - Increase by about 70% for dpa in SS316-L(N)-IG
- Difference observed in the ITER 1D benchmark within 10% (far away from the plasma region)
- On-going JADE development focused on enhancement of the benchmark libraries, capability to deal with D1S libraries and improvement of the general user experience.

ACKNOWLEDGEMENTS / REFERENCES

The authors would like to thank the IAEA nuclear data section for its support and for an early sharing of the FENDL v3.2 Beta release. They also would like to thank M. Sawan and T. Bohm for sharing their know-how on the ITER 1D benchmark. The views expressed in this publication are the sole responsibility of the authors and do not necessarily reflect the views of Fusion for Energy or IAEA.